

REMARKS

Claims 1-11 have been amended. Claims 12-48 were previously canceled as being drawn to a non-elected invention. New claims 49-55 have been added. Claims 1-11 and 49-55 are currently pending in this application. Applicants reserve the right to pursue the original and other claims in this and other applications. Applicants respectfully request reconsideration in light of the above amendments and the following remarks.

The Title has been amended to more closely conform with the scope of the pending claims.

Claim 5 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claim 5 has been amended to recite a micro-lens array wherein “differing focal points of the plurality of micro-lenses focus light to different depths in the semiconductor substrate.” Applicants respectfully submit that the language of claim 5 is supported and explained in ¶[0030] of the Specification as follows: “individual micro-lens structures can be formed for each type of color pixel cells to take advantage of the different absorption depths of light in the substrate due to different wavelengths of light which pass through the various filters. ... Thus, forming micro-lenses with structural differences depending on the wavelength of light detected by a pixel cell enhances the light received at each photosensor by controlling the position of the focal point for each micro-lens.” As such, Applicants submit that claim 5 is in compliance with 35 U.S.C. § 112, second paragraph. Applicants respectfully request that the rejection of claim 5 be withdrawn and the claim allowed.

Claims 1, 2 and 6 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Ozawa (U.S. Patent No. 6,781,762) (“Ozawa”). This rejection is respectfully traversed and reconsideration is respectfully requested.

Claim 1 recites a micro-lens array including a “semiconductor substrate positioned over an array of pixel cells, the semiconductor substrate having a bottom surface facing towards the pixel cells and an upper surface opposite the bottom surface,” an “an opening in the semiconductor

substrate recessed below the upper surface of the substrate, the opening serving as a mold for a plurality of micro-lenses” and “lens material located within the opening mold of the semiconductor substrate.” Further, the “lens material forms the plurality of micro-lenses, each of the micro-lenses having a respective focal point, wherein the focal point of at least one of the plurality of micro-lenses differs from the focal point of at least one other of the plurality of micro-lenses.”

Ozawa does not disclose, teach or suggest the “plurality of micro-lenses, each of the micro-lenses having a respective focal point, wherein the focal point of at least one of the plurality of micro-lenses differs from the focal point of at least one other of the plurality of micro-lenses” as required by the claimed invention. In the micro-lens array of Ozawa, each of the micro-lenses is the same. See, e.g., Ozawa FIGS. 1, 2 and 11. On the other hand, in the micro-lens array of the claimed invention, the micro-lenses are formed of varying shapes/sizes, and therefore, have varying focal lengths across the opening. See, e.g., Specification ¶[0019], FIG. 2G. Varying the focal lengths allows the light received at each photosensor to be enhanced by controlling the position of the focal length for each micro-lens. Specification, ¶[0030].

Accordingly, claim 1 is allowable over the cited combination. Claims 2 and 6 depend from claim 1 and are allowable along with claim 1. Applicants respectfully request that the rejection of claims 1, 2 and 6 be withdrawn and the claims allowed.

Claim 3 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Ozawa in view of Nishihara (U.S. Patent No. 5,764,319) (“Nishihara”). This rejection is respectfully traversed and reconsideration is respectfully requested. Claim 3 depends from claim 1. Claim 1 is allowable in view of Ozawa for at least the reasons discussed above. Nishihara is relied upon as disclosing that the microlens can be formed in aspheric shape to correct aberrations (Office Action at page 4) and does not remedy the deficiencies of Ozawa as to claim 1. Accordingly, claim 3 is allowable over the cited combination. Applicants respectfully request that the rejection of claim 3 be withdrawn and the claim allowed.

Claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Ozawa in view of Kravitz (U.S. Patent No. 5,790,730) (“Kravitz”). This rejection is respectfully traversed and reconsideration is respectfully requested. Claim 4 depends from claim 1. Claim 1 is allowable in view of Ozawa for at least the reasons discussed above. Kravitz is relied upon as disclosing that using a silicon dioxide substrate with a micro-lens is well known in the art (Office Action at page 4) and does not remedy the deficiencies of Ozawa as to claim 1. Accordingly, claim 4 is allowable over the cited combination. Applicants respectfully request that the rejection of claim 4 be withdrawn and the claim allowed.

Claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Ozawa. This rejection is respectfully traversed and reconsideration is respectfully requested. Claim 7 depends from claim 1. Claim 1 is allowable in view of Ozawa for at least the reasons discussed above. Accordingly, claim 7 is allowable over Ozawa. Applicants respectfully request that the rejection of claim 7 be withdrawn and the claim allowed.

Claims 8-11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ozawa in view of Kravitz and further in view of Nishihara. This rejection is respectfully traversed and reconsideration is respectfully requested.

Claim 8 recites a micro-lens array including a “semiconductor substrate positioned over an array of pixel cells, the substrate having a bottom surface facing towards the pixel cells and an upper surface opposite the bottom surface,” an “opening in the substrate recessed below the upper surface of the semiconductor substrate,” and “lens material located within the opening of the substrate.” The “substrate [is] formed of silicon dioxide.” The “opening serv[es] as a mold for a plurality of micro-lenses.” Further, the “opening mold is shaped such that the lens material corrects for optical aberrations, and wherein the lens material forms the plurality of micro-lenses, each of the micro-lenses having a respective focal point, wherein the focal point of at least one of the plurality of micro-lenses differs from the focal point of at least one other of the plurality of micro-lenses.”

As discussed above with respect to claim 1, Ozawa does not disclose teach or suggest at least a micro-lens array including a “plurality of micro-lenses, each of the micro-lenses having a respective focal point, wherein the focal point of at least one of the plurality of micro-lenses differs from the focal point of at least one other of the plurality of micro-lenses.” As such, claim 8 is not obvious in view of Ozawa. Accordingly, claim 8 is allowable over the cited combination. Claims 9-11 depend from claim 8 and are allowable along with claim 8. Applicants respectfully request that the rejection of claims 8-11 be withdrawn and the claims allowed.

New claims 49-55 depend from claims 1 and 8, and therefore are allowable along with claims 1 and 8 and because of the additional limitations recited therein.

In view of the above, Applicants believe the pending application is in condition for allowance.

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Respectfully submitted,

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